Quality of New Hampshire Lakes & Ponds

A Layman's Guide

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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Introduction

Lakes are an important natural resource to both the citizens of New Hampshire and to its visitors. Lakes provide enjoyment through many recreational activities such as swimming, fishing, and boating. The people who utilize these lakes provide an important source of revenue for many New Hampshire communities and the State of New Hampshire. It must be realized that lakes are not unalterable systems. The natural lake aging process whereby a lake becomes enriched and gradually fills in can be greatly accelerated by the activities of man. It is extremely important that we all take the necessary steps to preserve New Hampshire's lakes and ponds as valuable recreational resources and to minimize the effects of man on them. The Biology Section of the New Hampshire Department of Environmental Services, Water Division, serves an important role in the preservation of New Hampshire lakes by determining the condition of the lakes, by identifying problem areas and initiating corrective action, and by informing the public of its findings.

Considerable amounts of chemical and biological data have been collected from New Hampshire's lakes since 1975 as part of the lake trophic survey program (LTSP). A listing of the data most often sought by lake residents, lake associations, home buyers and real estate professionals is presented in Appendix A, and the sources and explanation of that data are itemized below. If you require additional information or just have a particular question, please feel free to call or write this office. Thank you for being concerned about the well being of the quality of New Hampshire's lakes.

This report lists water quality data from 807 different lake stations, representing 775 different lakes, collected as part of LTSP. Many of the lakes and lake stations have been surveyed more than once and data from all survey dates are included. The chemical data listed is the summer, epilimnetic or upper water layer value. Appendix C lists lakes that participate in the Volunteer Lake Assessment Program (VLAP). Data from that program is available on the web at www.des.state.nh.us/wmb/vlap/.

Sources and Explanation of Data

This section describes the lake quality data presented in appendix A. The sources of the data listed, or the methodologies of calculating that data are outlined. Also, generalized explanations in layman's terms are provided for the data to assist the reader in understanding a particular lake or pond of interest.

LAKE

The name of the lake, pond, or reservoir, as listed in the New Hampshire State Planning Project publication (NHSPP, 1964). There may be alternate names used locally for a lake.

TOWN

The municipality in which the largest part of the water body is located, from NHSPP, 1964.

COUNTY

The county in which the water body (or largest portion) is located, from NHSPP, 1964.

AREA

The surface area of the lake to the nearest 0.1 acre, from NHDES, 1994.

ZMAX

The maximum depth, to the nearest 0.1 foot, found in the lake during the current survey. Prior to 1986 a field value was listed only if greater than any published historical value.

DATE

The date the summer field survey was conducted.

pH

A measure of the hydrogen ions in the water or, in general terms, the acidity. New Hampshire lakes historically have had pH values in the mid to upper sixes in most cases. As the pH decreases to between 5 and 6, many fish and other aquatic organisms become stressed, and some disappear. Little or no fish life remains when the pH falls much below 5.

Category	pH (units)
Acidified	< 5
Critical	5.0 – 5.4
Endangered	5.5 – 6.0
Satisfactory	6.0 – 8.0

ALK

Alkalinity or acid neutralizing capacity (ANC) measures the buffering capacity of a lake to neutralize acid inputs. New Hampshire has historically had naturally low alkaline waters because of granitic bedrock. The median ANC for New Hampshire's lakes is only 4.9 mg/L.

Sensivity Category	ANC (mg/L)
Acidified	<0
Critical	>0 – 2
Endangered	>2 – 5
Highly Sensitive	>5 – 10
Sensitive	>10 – 20
Not Sensitive	>20

COLOR

A visual measure of the color of water. This color is generally caused by decaying organic matter and by naturally occurring metals in soils, such as iron and manganese. A highly colored lake generally has extensive wetlands along the shore or within the watershed, and often a mucky bottom. Color by itself does not indicate the quality of a particular waterbody.

Apparent Color	Units
Clear	0-25
Light Tea-colored	25-40
Tea-colored	40-75
Highly colored	>75

COND

Conductivity is a measure of the ability of water to conduct an electric current. It is determined primarily by the number of ionic particles present. The soft waters of New Hampshire have traditionally had low conductivity values. Specific categories of good and bad levels cannot be constructed for conductivity because variations in watershed geology can result in natural fluctuations in conductivity. However, values in New Hampshire lakes exceeding 100 µmoles/cm generally indicate cultural (man-made) sources of ions, such as salted highways and runoff from urbanized areas.

TP

Total phosphorus, or a measure of all the phosphorus forms present in the water, including both inorganic and organic forms. Phosphorus is the limiting plant nutrient in NH lakes. Its concentration determines the amount of plant growth possible, which directly relates to trophic state and the perceived aesthetics of the lake. Values less than 0.010 mg/L generally indicate oligotrophic waters, values greater than 0.020 mg/L indicate eutrophic waters, while mesotrophic conditions exist between these two values (see description of **CLASS** on p. 5). Excessive amounts of total phosphorus may impair the aesthetics and recreational use of a lake by causing increased rooted plant growth and obnoxious blooms of algae.

Category	TP (mg/L)
Low (good)	.001 - .010
Average	.011 - .020
High	.021 - .040
Excessive	> .040

CHL-A

Chlorophyll-a is a measure of the phytoplankton or floating algal biomass (abundance) found in lakes and ponds.

Category	Chlorophyll-a (mg/cubic meter)
Good	0 - 5
More Than Desirable	5.1 – 15
Nuisance Amounts	>15

SECCHI

A measure of water clarity or a measure of the distance one can see into the water. This depth is variable with weather conditions, suspended matter (usually algae) in the water and the eyesight of the observer. A 20 centimeter black and white disk (Secchi Disk) lowered into the water on a calibrated chain is used to estimate this depth.

Category	Transparency (FT)
Poor	<4
Good	4 – 15
Exceptional	>15

PLANTS

A measure of the abundance of rooted (usually) aquatic plants in a lake. Aquatic plants are a natural component and vital link to a healthy and diverse aquatic ecosystem. When aquatic plants interfere with man's activities, the plants are quickly designated "weeds". Complete eradication of native weeds is not recommended! Plant abundance in a lake is subjectively evaluated using the following terms in order of relative abundance.

Abundance	Description
Sparse	Few emergent plants observed: submerged plants not obvious.
Scattered	Several small patches or 1 or 2 large patches or much of shoreline with a sparsely growing plant; submerged plants not obvious.
Scattered/Common	Intermediate between Scattered and Common.

Common	Plants around most of the shoreline but not a problem to navigation or several large patches of plants.
Common/Abundant	Intermediate between Common and Abundant.
Abundant	Plants around entire shoreline and with thick patches in some areas.
Very Abundant	At least ½ of the surface area with emergent plants or submerged plants thick throughout the lake; navigation and swimming impaired.

CLASS

Class is a designation of the trophic classification of a lake. New Hampshire's Trophic Classification System places lakes into similar groups according to algal production, rooted plant growth, water clarity and bottom dissolved oxygen levels (see table on following page). A lake or pond can be placed in one of the following classes:

OLIGO – Oligotrophic lakes are usually nutrient poor and as a result do not support nuisance algal blooms or extensive rooted plant infestations. Aesthetically, these lakes are the best of the three ratings and include most of the larger, deeper lakes.

MESO – Mesotrophic is intermediate between an oligotrophic and eutrophic waterbody. Algal production is moderate. Phosphorus input and water clarity are also intermediate compared to the other two lake ratings. If the lake is abused it eventually may move into the eutrophic category.

EUTRO – Eutrophic lakes are characterized by a high production of algae and aquatic plants, which indicates that the system is receiving an overabundance of phosphorus. Water clarity is reduced dramatically during algal blooms. These ponds tend to be shallower with mucky bottoms.

A **BLANK** entry under class indicates that sufficient data is not available to properly classify the pond.

BTTM DO

A measure of the dissolved oxygen concentration at the deepest point in the lake during the summer. Adequate dissolved oxygen is important for the ongoing survival of fish populations, especially cold-water species such as trout and salmon. A full understanding of the significance of a given bottom dissolved oxygen level to a lake and its trophic status is possible only if information on water temperature, thermal stratification and lake and hypolimnetic volumes are known (see item # 1 in Table on following page). The bottom dissolved oxygen criteria is not used in the trophic classification of lakes with no hypolimnions (the bottom layer of a thermally stratified lake). Temperature data is not presented in this report.

TROPHIC CLASSIFICATION SYSTEM FOR NEW HAMPSHIRE LAKES AND PONDS

Trophic Points

1. Summer Bottom Dissolved Oxygen:

a. D.O. >4mg/L 0
b. D.O. = 1 to 4 mg/L & hypolimnion volume ≤10% lake volume 1
c. D.O. = 1 to 4 mg/L & hypolimnion volume >10% lake volume 2
d. D.O. <1mg/L in <1/3 hypo. volume & hypo. volume ≤10% lake volume 3
e. D.O. <1mg/L in ≥1/3 hypo. volume & hypo. volume ≤10% lake volume 4
f. D.O. <1mg/L in <1/3 hypo. volume & hypo. volume >10% lake volume 5
g. D.O. <1mg/L in ≥1/3 hypo. volume & hypo. volume >10% lake volume 6

2. Summer Secchi Disk Transparency:

a. > 7m 0
b. > 5m – 7m 1
c. > 3m – 5m 2
d. >2m – 3m 3
e. >1m – 2m 4
f. >0.5 – 1m 5
g. ≤0.5m 6

3. Aquatic Vascular Plant Abundance:

a. Sparse 0
b. Scattered 1
c. Scattered/Common 2
d. Common 3
e. Common/Abundant 4
f. Abundant 5
g. Very Abundant 6

4. Summer Epilimnetic Chlorophyll-a (mg/m^3):

a. <4 0
b. 4 - <8 1
c. 8 - <12 2
d. 12 - <18 3
e. 18 - <24 4
f. 24 - <32 5
g. ≥32 6

Trophic Classification	Trophic Points Stratified	*Unstratified
Oligotrophic	0-6	0-4
Mesotrophic	7-12	5-9
Eutrophic	13-24	10-18

*Lakes without hypolimnions are not evaluated by the bottom dissolved oxygen criterion.

Statistical Summary Information

To provide an understanding of how a particular lake compares to other New Hampshire lakes, the following table summarizes key biological and chemical parameters for all the state's lakes, using the most recent summer, upper water level data.

Parameter*	Number	Min.	Max.	Mean	Median
pH (units)	780	4.3	9.3	**6.5	6.6
Alkalinity	781	-3	85.9	6.6	4.9
Color (units)	759	<5	250	---	28
Conductivity (µmhos/com)	768	13.1	696	59.4	40.0
Total Phosphorus	772	<0.001	0.121	---	0.012
Chlorophyll-a (µg/L)	776	0.19	143.8	7.16	4.58
Secchi Disk (ft.)	663	1.3	42.6	12.1	10.5

**All parameters in mg/L unless otherwise noted.*
*** True mean pH*

Legal Use Classification – Legislative

Each waterbody is assigned a letter classification, which corresponds to the designated use of that water. The two classifications are described below. In general, Class A lakes are public water supplies and Class B lakes are recreational lakes. **The class designation is a statement of the use of the lake and not a statement of current water quality.** A Class B lake may have higher quality water than a Class A lake.

Class A

These waters are of the highest quality and are potentially acceptable for water supply use after disinfection. A partial list of Class A lakes follows in appendix B.

Class B

Waters having this classification are potentially of the second highest quality and are acceptable for swimming and other recreation, fish habitat, and for use as a water supply following adequate treatment.

Literature Cited

New Hampshire Department of Environmental Services. 1994. Official List of Public Waters in New Hampshire. Revised Edition. NHDES-WRD-91-4.

New Hampshire State Planning Project. 1964. New Hampshire Public Water Bodies and Public Access Points. Report No. 4. State of New Hampshire. 100pp plus maps.